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# An Outcomes Comparison of Treatment of Cervical Dysfunction by Strain/Counterstrain or Mckenzie's Exercises

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# AN OUTCOMES COMPARISON OF TREATMENT OF CERVICAL DYSFUNCTION BY STRAIN/COUNTERSTRAIN OR MCKENZIE'S EXERCISES

by

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This Independent Study, submitted by Heather A. Sorum in partial fulfillment of the requirements for the Degree of Master of Physical Therapy from the University of North Dakota, has been read by the Faculty Preceptor, Advisor, and Chairperson of Physical Therapy under whom the work has been done and is hereby approved.

(Faculty Preceptor)

(Graduate School Advisor)

(Chairperson, Physical Therapy)

PERMISSION

Title An Outcomes Comparison of Treatment of Cervical Dysfunction by Strain/Counterstrain or McKenzie's Exercises

Department Physical therapy

Degree Masters of Physical Therapy

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Signature Heather Sorum

Date 1/10/98

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

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## ABSTRACT

Manual therapy techniques such as Strain/Counterstrain and McKenzie's exercises must be formally studied and scientifically proven in order to receive reimbursement from third party payers. The purpose of this study was to compare the effectiveness and outcomes of SCS and McKenzie protocol on cervical somatic dysfunction by performing a chart review. Twenty-six adult subjects who were previously diagnosed with cervical somatic dysfunction were included (McKenzie group n=10, SCS n=16). Subjects were not significantly different in age, sex, or cause of dysfunction. Results: paired sample t tests showed a significant reduction in pain for the SCS group ($p<.05$). The SCS group had a shorter treatment duration, fewer treatments, and lower cost although ANOVA showed that they were not statistically less than the McKenzie group. Paired samples t test showed a significant improvement in all cervical motions except extension for the SCS group ($p<.05$). Based on the results of this chart review, the SCS protocol is as effective as the McKenzie protocol in treating cervical somatic dysfunction, and SCS is effective in treating pain and increasing cervical ROM for patients with cervical dysfunction.

## Chapter 1

## Introduction

As health care reform evolves, there have been changes in determining how health care providers are being reimbursed for services. Included in those changes are how health insurance companies and Medicare decide the quantity they will reimburse, and also which services to reimburse. In July 1997, the House of Representatives was considering to extend an existing Medicare cap of $900 on independent practice outpatient rehab services to other areas of health care including rehabilitation agencies, outpatient rehab facilities, skilled nursing facilities, and physicians' offices.[1] By August 1997, a new agreement was settled with the reimbursement cap set at $1500 to begin in 1999.[2]

Medicare coverage is not only limited by a dollar amount, but also by which services are provided. In July 1997, Medicare terminated coverage for electrical stimulation (e-stim) for wound care. This decision was based partially on comparisons of e-stim to other therapies covered by Medicare. It was not shown to be "markedly superior" in it's effectiveness in healing wounds compared to other treatment methods performed in physical therapy.[3] The American Physical Therapy Association has filed for an injunction to overturn the decision.[3]

Treatment modalities are not the only area of physical therapy under scrutiny by Medicare and health insurance companies. Manual therapy techniques such as McKenzie's, Cyriax, and Strain/Counterstrain must also be formally studied, to determine their effectiveness and quality of outcome. Years of clinical experience and the body of

knowledge that comes with that experience, no matter how widely the manual techniques are accepted in the profession, are not enough anymore. The **problem** is that Strain/Counterstrain (SCS) is one manual therapy technique which does not have scientific nor case studies to substantiate its claims. The **purpose of this study** is to compare the effectiveness and outcomes of SCS and McKenzie's exercises on cervical somatic dysfunction by performing a chart review . The **significance of this study** is to expand the body of knowledge that exists regarding the effectiveness of Strain/Counterstrain on pain levels, range of motion, the number of treatments, and the total amount of time it takes for return to function compared to McKenzie's exercises which has been studied with clinical trials. The results will provide physical therapists better insight into the development of criteria for creating treatment protocols for their patients, and will also ensure patients, Medicare, and health insurance companies that patients are receiving quality care with proven benefits and outcomes. Documented results also increase the likelihood that physical therapy techniques utilized with patients will continue to be reimbursed.

The following are **research questions** related to somatic dysfunction which will be addressed with this study: What are the outcomes comparisons of patients treated with either a SCS program or a McKenzie program, with outcomes to include patient subjective pain, cervical range of motion, treatment duration, total number of treatments, and functional abilities? How does the total cost of treatment compare between patients treated with SCS or McKenzie's? What SCS positions are most often associated with cervical somatic dysfunction? Are there any specific combination of exercises or modalities which are more effective than others?

The **null hypotheses** for the research questions would be that SCS has no significant differences on the effects of pain, cervical range of motion, treatment duration, number of treatments, or functional outcomes compared to McKenzie's exercises. The following are alternate hypotheses related to these questions: SCS is more effective than

McKenzie's in decreasing pain and increasing range of motion; SCS patients require a shorter treatment duration and fewer number of treatments, and therefore, the cost of treatment is less than patients treated with McKenzie's exercises. SCS improves functional outcomes as well as McKenzie's program.

## Chapter II

## Review of the Literature

Strain/Counterstrain (SCS) is a treatment method that is becoming more widely accepted for the treatment of a musculoskeletal disorder termed somatic dysfunction. Somatic dysfunction has been described as decreased functioning in a musculoskeletal area. Affected systems may include vascular, lymph, and nervous system due to a strain.[4-7] The term somatic dysfunction has replaced the term "osteopathic lesion" used in earlier literature.[5] The diagnosis of somatic dysfunction is defined by asymmetry of motion surrounding a joint, restricted motion, and tissue texture abnormalities commonly associated with inflammation.[8] These tissue texture changes, called tender points, have been described as pea-sized areas of muscle that may be spasmed, spongy with edema due to musculoskeletal dysfunction, and four times more tender to palpation compared to normal muscle tissue.[4,6] Somatic dysfunction is caused by a strain, which is defined as overstretching of muscles, tendons, ligaments, and fascia. This strain occurs at or during the return from the strained position in SCS.[4] Neuromuscular reflexes may be impaired as well.[4]

Lawrence H. Jones discovered and developed the technique of SCS during his 30 years of clinical experience as an osteopath.[4] He discovered SCS by accident when working with a thirty year old male who had severe back pain. The patient came to Jones one month after his pain had begun, and Jones treated him for three months without success. The patient had difficulty sleeping at night, waking every fifteen minutes and trying to find a comfortable position. So Jones tried positioning him, asked if he felt

more or less pain, and continued repositioning until the patient reported being nearly comfortable. Jones left the room, leaving the patient in that same twisted position propped on pillows. When Jones returned to the room, the patient eased off the treatment table and had no pain! The patient was able to stand fully upright.[9]

Jones experimented in his clinic and applied the same principles to other patients.[9] He treated a male patient who could not come out of a flexed lumbar position. The man felt good enough to hoe in his garden three days later, but in doing so, stuck the end of his hoe near his groin causing excruciating pain. The man thought he had "ruptured" something, but Jones assessed him and found no symptoms of an inguinal hernia, despite the tender spot. The man had made an appointment for the following day for his low back, but Jones treated him then to save him the trip. While positioning him into extreme lumbar flexion and rotation, Jones palpated the tender area at the groin, but it was nearly gone. This was how Jones began to postulate that there were anterior tender points associated with lumbar pain.[9]

A third example is his middle-aged factory man, who would nap on the couch before supper.[9] While lying supine, his arm would hang off the edge of the couch. His wife who became concerned about his position would slowly raise it and place it back on his chest so as to not wake him. The man never had any pain, until one day his wife was out and the phone startled him awake, and he quickly flexed his elbow. He immediately had pain in his biceps, which worsened in the forthcoming days. He had pain especially with resisted flexion, and the muscle atrophied and weakened. Other physicians considered surgery, but since they could not palpate any tenderness in the biceps, surgery was foregone. The man saw Jones two years later, and Jones discovered a sharp tender point on the olecranon process. Jones treated the patient by positioning the elbow in hyperextension and holding it there. This position relieved half of the patient's pain, and a "few more" treatments brought him "complete recovery" without recurrent episodes.[9] Jones provides anecdotes of how he discovered and refined the technique while working

with patients with somatic dysfunctions.[4,9] These examples are vague and lack the depth of information that case studies would provide.

Jones then performed a literature review to find research which explained his clinical findings. He found studies in the area of neurophysiology by I.M. Korr which he believes explain the rationale behind the clinical results he was witnessing.[4,10] Figure 1 is a review of muscle neurophysiology. Korr measured electromyelographic (EMG) activity in normal, resting spinal muscles and found no EMG activity at times. At other times, he found activity until the body was repositioned, thus eliminating EMG activity.[11] In lesioned areas, there are neurons in muscles which cause muscles to contract when they are shortened.[12] The gamma motor neurons, or efferents, would be near firing and maintaining a hyperactive state.[12] But when the body was slowly positioned and repositioned, the efferents showed decreased EMG activity.[11] Korr later theorized that the lesioned areas showed gains in EMG activity due to increased muscle spindle activity causing the gamma to be set at too high of a frequency therefore, causing the intrafusal muscle fibers to be shortened.[13] The overall clinical result is a reflexive muscle spasm.[14] When this muscle spasm is stretched, an increase in spindle and GTO firing is seen, but when it is shortened there is decreased or abolished firing and muscle relaxation occurs.[14] Since there is more gamma activity with the muscle spasm, the muscle spindle must be shortened even further in order to reach resting.[13] In addition to the shortened position needed to decrease firing, Korr theorized that the slow motion, as used in the study when repositioning the body into neutral, must also be utilized.[14] This slow movement allows the central nervous system to tell the gamma discharge to decrease without experiencing any "surprises" which could potentially increase the gamma again.[14] I could find no other studies related to the direct use of SCS with its positions and techniques as described by Jones.

Jones relates the neurophysiological findings of Korr to the patient previously described with the strained biceps.[9] Normally, the biceps and triceps fire at the same rate

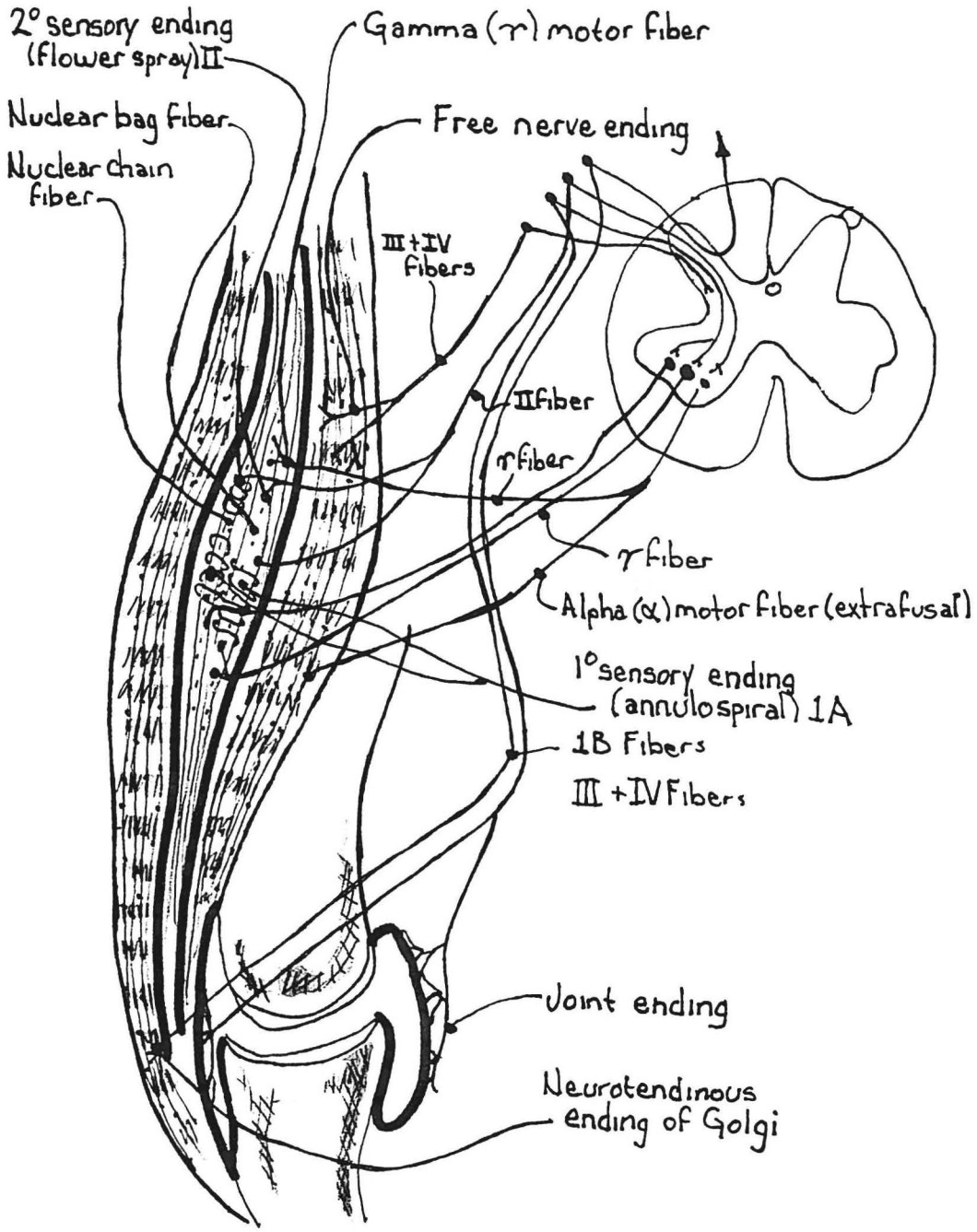


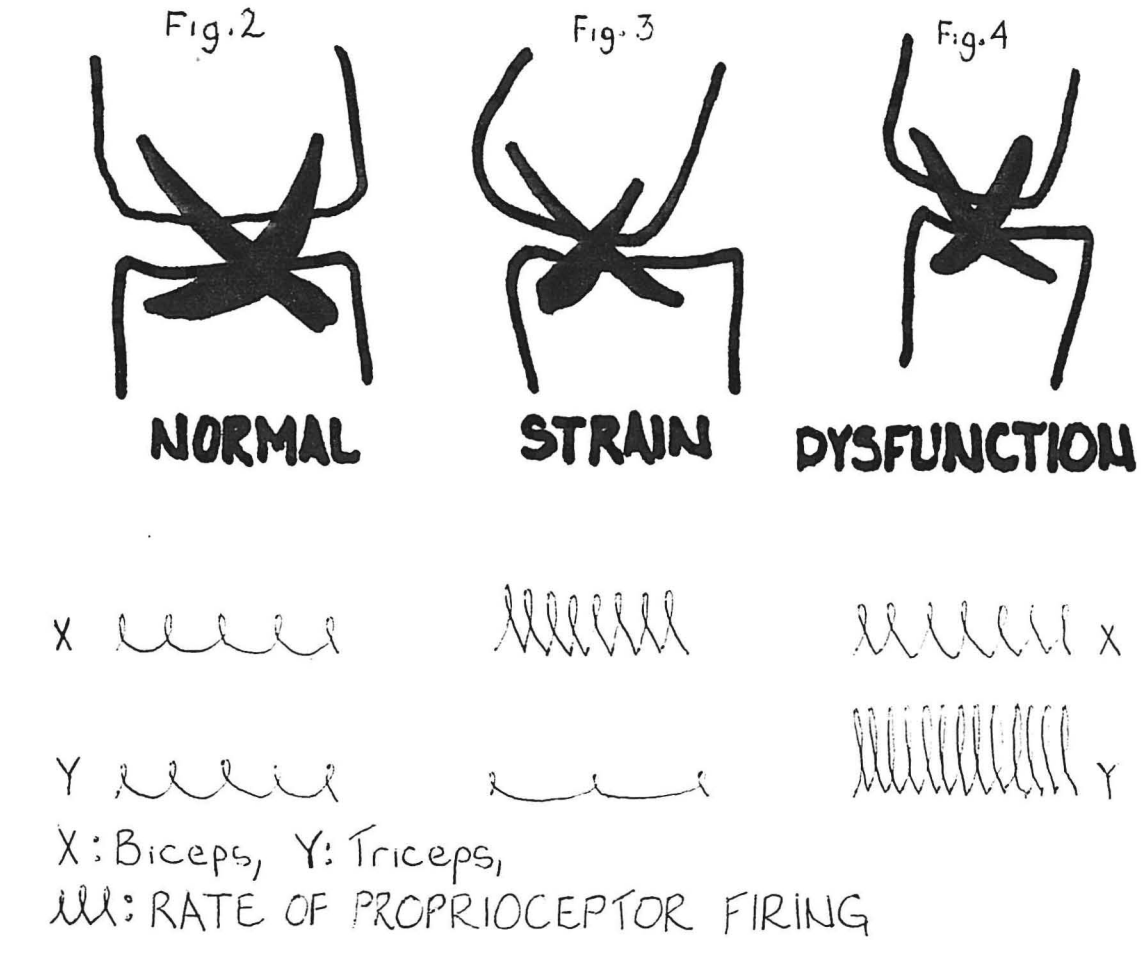

**Fig. 1 NORMAL NEUROMUSCULAR ANATOMY**

Adapted from Pansky.[12]

(Figure 2). The triceps, the antagonist to the biceps, was placed in a prolonged and extremely shortened position when his arm hung down from the couch (Figure 3). When the phone rang, the triceps experienced a very sudden lengthening and an increase of the proprioceptive activity (Figure 4). The proprioceptors remain hyperactive, even when not on stretch, and send a false message of strain. This results in a tender point in the triceps. By positioning the triceps back into hyperextension, the proprioceptive activity is able to decrease and reset itself back to the normal firing rate. As Korr found, the slow return to neutral prevents restimulating hyperactivity in the proprioceptors of the antagonistic triceps.[9] This is the rationale that Jones provides for the basis of SCS effectiveness.

To perform the procedure of SCS, the physical therapist locates tender points (see Figures 5,6), and then slowly and passively positions the patient. This passive positioning causes a counterstrain, a mild strain in the opposite direction of original strain, to the muscle.[4] Each tender point found corresponds with a specific treatment position, called a position of relief. The location of the position is often similar to the original injury position.[4] In the cervical area, there are ten tender points on the anterior surface, and eleven on the posterior surface[4] (Figures 5, 6). The therapist holds the patient in the position of relief for 90 seconds, and palpates the tender point occasionally to monitor tissue texture and patient subjective pain level changes. The therapist then very slowly returns the patient back to neutral.[4,5,14-17]

While not formally studied, the purported results of using SCS for somatic dysfunction results in a disappearance of edema[4,10] and muscle tension as the tender point relaxes.[10,15] One author reports that range of motion shows "marked improvement,"[10] and others state that pain decreases by approximately 60-70% immediately following treatment.[4-6,10,15] The next day or two following treatment, patients may experience mild soreness similar to delayed onset muscle soreness following




Adapted from Jones.[9]

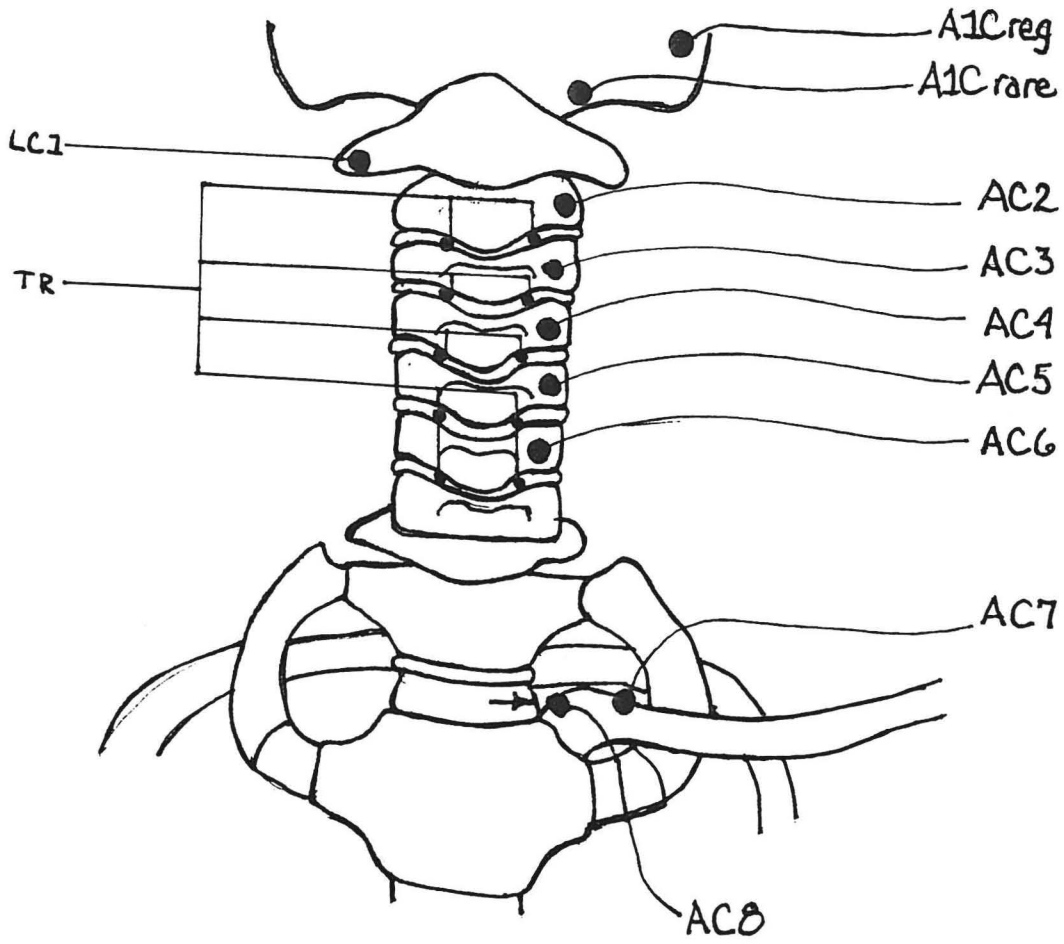



Fig.5 ANTERIOR CERVICAL TENDER POINTS

Adapted from Jones.[9]

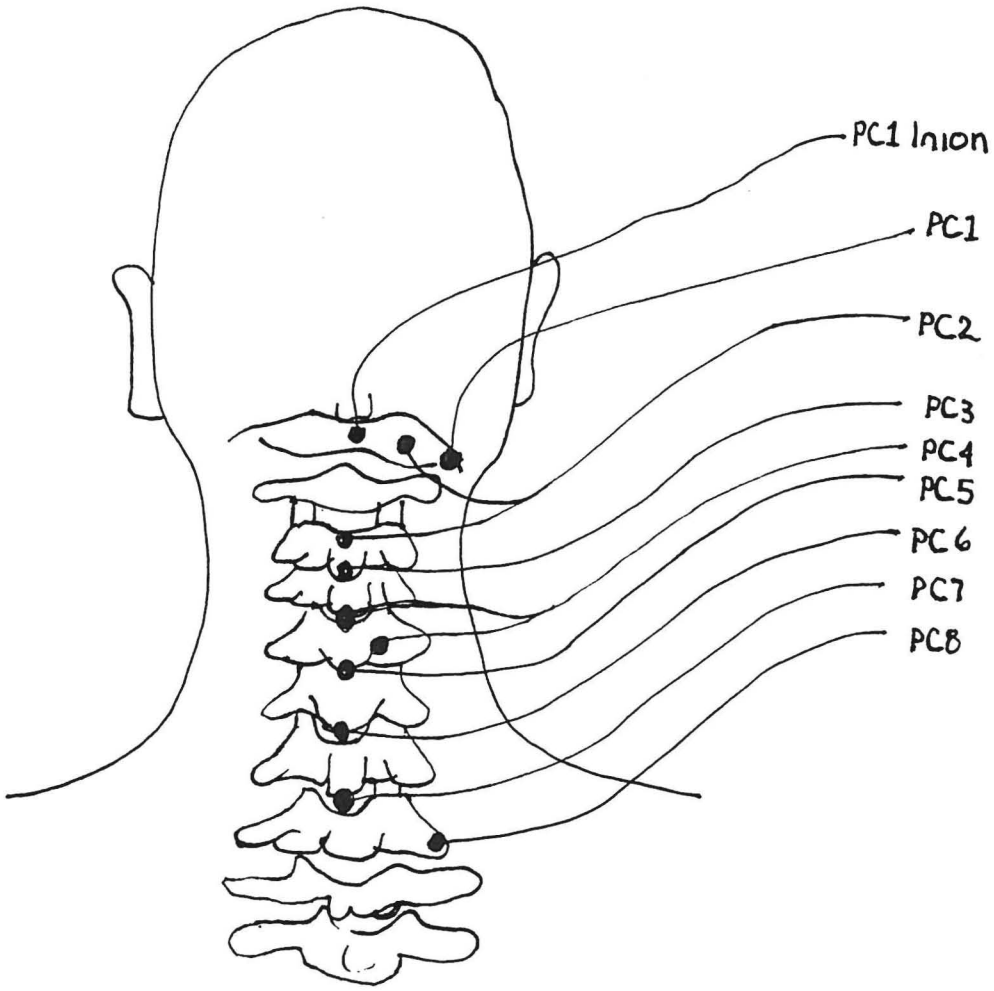



**Fig. 6 POSTERIOR CERVICAL TENDER POINTS**

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Adapted from Jones.[9]

light exercise.[4,6] The success of SCS depends on whether or not a position of relief was achieved during treatment.[10] Controversy in the literature surrounds the number of SCS treatments to achieve results. While Jones states that repeated sessions may be needed to maintain the results until the muscle tissues heal,[10] Schwartz states that the results are lasting and daily treatments with SCS are not necessary unless a patient's neuroreflexes are strong.[15]

Due to the reported positive results that SCS has with somatic dysfunction and the fact that it is a non-invasive and gentle technique, clinicians have utilized SCS with a variety of conditions and patients. Reports indicate use in acute and chronic conditions of somatic dysfunction,[15,18,19] fractures,[20] osteoporosis,[15] low back pain,[18,19] adhesive capsulitis,[20] and foot/ankle conditions.[21] Schwartz states that he has used SCS, without negative side effects, to treat somatic dysfunction in patients who also had the following secondary or accompanying conditions: congestive heart failure, respiratory failure, pneumonia, bronchitis, asthma, and myocardial infarction.[15] Jones, on the other hand, contradicts Schwartz on using SCS with patients with cardiac involvement, and does emphasize caution when considering use of SCS with patients with "a recent or poorly organized coronary accident."[6] Patient populations which have been treated with SCS range in age from the elderly to infants.[19,20] Pregnant women, whose condition is often times a contraindication for other treatment techniques, have reportedly received SCS without negative side effects as well.[15,19,20]

**Mechanical Diagnosis and Treatment by McKenzie's Exercises**

McKenzie's exercises are another type of treatment utilized with patients with somatic dysfunction. These exercises were developed during the 1960's by Robin McKenzie, a New Zealand physical therapist who is recognized internationally as an expert in diagnosis and treatment of low back pain, and who has also developed a series of exercises for cervical patients with pain caused by mechanical stresses.[22,23]

Mechanical stresses or deformation create pain when normal body structures are overstretched, tight areas stretched, or if a "derangement of an articulation" has occurred.[22] Mechanical pain may be intermittent or constant, and is affected by position and movement of the body.[22] Pain receptors, called nociceptors, are stimulated not only by mechanical stresses, but also by chemical stimulation.[12] Chemical pain is described as constant and localized, and not affected by movement or position as mechanical pain is affected.[24]

McKenzie has applied these pain characteristics of motions and applied them to mechanical diagnosis and treatment of the cervical spine.[22-24] First, McKenzie classifies patients into three groups of syndromes 1) postural, 2) dysfunction, and 3) derangement.[22,24,25] The syndromes are differentiated by patient symptoms of pain and how they relate to repetitive activities, range of motion, and tissue pathology. The postural and dysfunction syndromes correlate with Strain/Counterstrain's somatic dysfunction, whereas the derangement does not. The following descriptions of each McKenzie syndrome will detail the relationship.

The postural syndrome is characterized by intermittent pain next to the spine, without any symptoms radiating into the scapula or arm.[22,24] The tissues are normal but are experiencing abnormal stresses from prolonged positioning, such as poor sitting or standing postures, at the end of range.[22,24] The patient possesses full cervical range of motion and does not have pain at end range or during the range. Symptoms develop gradually over time.[22]

With the dysfunction syndrome, however, symptoms develop following a motor vehicle accident or following an episode of acute cervical pain.[22,24] Cervical range of motion is limited. Pain is usually intermittent, localized and adjacent to the spine, and felt at end range of motion.[22,24] Dysfunction syndrome is characterized by normal stresses on abnormally tight tissues which developed secondary to adaptive shortening with poor postures, or to trauma with scarring during the repair process.[24] This is similar

to the model described by Jones in SCS with the tissues' maladaptive firing response to normal stresses. The tissues involved may include the joint capsule, intervertebral disc annulus, ligaments, or muscles.[24]

The third syndrome, the derangement syndrome, involves pathology of the intervertebral disc, nucleus pulposus, and possibly the annulus fibrosis.[22] SCS does not involve these structures outside the neuromuscular elements previously described. McKenzie's philosophy is that the nucleus or annulus may be displaced which creates displacement of the adjacent vertebral positioning.[22] The resulting deformities can include torticollis and decreased cervical lordosis. The disc displacement can vary, with minor derangement and minimal damage to the annulus, to severe derangement and disc herniation.[22] McKenzie describes seven derangement syndromes which account for the varying positions and symptoms associated with damage of the disc.[22] Pain with these patients may be constant or intermittent, local or referred.[22,24] Pain occurs during movement with derangement syndrome, whereas pain with dysfunction syndrome occurs only at end range.[22,24] The pain usually develops suddenly following an incident or injury, but it may appear with an insidious onset as well.[22] The pain worsens with activities of sustained flexion, such as sitting, and motions toward the painful direction are limited.[22] Repeated motions or sustained positions may create, increase, decrease, or abolish symptoms.[22,24] Repeated motions may also centralize pain, which is the change in the location of pain from a radiated distal pain, to a more proximal central pain.[22,24] The direction of repeated motion which centralizes pain is utilized as a treatment direction. Repeated motions in the opposite direction, on the other hand, may cause peripheralization where the pain moves from a proximal location to a more distal one.[22,24] The McKenzie protocol goal is to centralize and subsequently eradicate pain with the repeated motions.[22-24]

McKenzie's philosophy stresses patient education in monitoring the effects of their treatment. For example, if symptoms are peripheralizing, then the patient stops the

exercise, but if pain is centralizing, they continue to perform the exercises.[22,23] Patients are taught to contine to exercise within their limits depending on pain severity as well.[22,23]

With these regular and predictable patterns of motion and pain associated with each syndrome, McKenzie incorporated these patterns into a patient evaluation system.[22] The evaluation includes the patient's profile, area and behavior of pain description, and history of current and previous cervical pain.[22] During the physical examination, the patient's posture is observed in sitting and standing, followed by assessment of their active motion in all directions for range and quality of movement.[22] Then motions are evaluated as related to pain symptoms. The motions are repeated so that the therapist may identify the syndrome, evaluate appropriateness of stretching procedures and which exercises to perform, and possibly rule out other diagnoses for which McKenzie's exercise protocol are contraindicated.[22] Further examination may also include evaluation of shoulder and thoracic spine mobility, a neurologic examination, and a vertebral artery test.[22]

After the examination, patient treatment begins. McKenzie's philosophy is that effective treatment involves these stages: 1) posture correction, 2) patient-directed exercise to restore function, 3) therapist techniques to assist the patient in restoring function, and 4) patient education in preventative treatment. For posture correction, McKenzie teaches cervical retraction, which is a posterior motion of the head in the saggital plane.[22,23,25]

McKenzie states that cervical retraction assists the patient in preventing the forward head posture often seen with sitting.[22] Pearson and Walmsley studied the immediate effects of the exercise on retraction range of motion (ROM) and resting neck posture on 30 normal females.[26] Cervical range was measured with a 3Space Isotrak System using markers over cervical spinous processes and the tragus, the small bulge of flesh just anterior to the external auditory opening. Statistical analysis found that

repeated neck retraction did not affect retraction ROM, but a significant improvement in resting neck posture into retraction was noted.[26]

After posture analysis and the education portion of a treatment session, exercise begins. McKenzie states that "the most important effects of mobilization and manipulation are increasing range of motion and relieving pain."[22] The exercises focus on stretching shortened tissues so that normal end range of motion can be gained.[22] Ten to 15 repetitions of movement are performed, with end range held for two seconds, and then a return to neutral, a position with a rest period of the same amount of time occurs before performing the next repetition.[22,23] For treatment of dysfunction syndrome, the exercises should be in the direction of the pain, according to McKenzie, in order to stretch the shortened tissues.[22] McKenzie's philosophy to stretching the shortened tissues is the opposite of the approach of SCS, in which the goal was not to stretch shortened tissues, but rather place the shortened tissues in a further shortened position in order to affect the neurophysiology as previously detailed.

The exercises that McKenzie utilizes are sitting head retraction, supine head retraction, sitting retraction with extension, sitting retraction with extension and rotation, sustained extension and rotation in supine, retraction and lateral flexion, retraction and rotation, and flexion.[22,23] If the patient is unable to regain mechanical motion with the exercises, then the therapist incorporates mobilizations and manipulations to regain lost motion.[22]

When treatment goals have been achieved, then the patient is educated to independently prevent future episodes of dysfunction by using correct posture and body mechanics, interruptions of awkward positions to reduce strain, and continued use of exercises.[22] McKenzie states that patient independence is a primary goal of his exercise program, and subsequently wrote two books for individuals looking to self-manage their neck and back pain.[23,27] These books use photographs and lay person's language to make the books user-friendly.

While there have been numerous studies that have been performed using McKenzie's exercises for the lumbar spine,[28-31] McKenzie's exercises for the cervical spine have not been extensively studied. Only one research article, previously discussed in this paper, has been published to this date regarding the effects of McKenzie's on the cervical spine.[26] It must be noted that this study used only females, and none had cervical involvement. More studies are needed in this area to study the effects of McKenzie's exercises on posture for those who do have cervical involvement.

## Chapter III

## Methodology

**SUBJECTS**: Twenty-six adult subjects, 18 years or older and previously diagnosed with cervical somatic dysfunction at a North Dakota physical therapy department were included in the study. The subjects had already received treatment by either Therapist A, a McKenzie-trained therapist, or by Therapist B, a Strain/Counterstrain-trained therapist. Subjects who returned to physical therapy for the same condition but from a second cause, such as a second motor vehicle accident or fall, were included for each treatment duration. Repeat subjects' scores were not summed, and were calculated separately from their initial treatment duration scores. Subjects with spinal cord symptoms, disk symptoms, vertebral artery insufficiency, or other peripheral involvement were excluded from this study.

**PROCEDURE**: Written consent from authorized personnel at the facility to perform a chart review was obtained prior to collection of data for this study (Appendix). A chart review of subjects previously treated by Therapist A and Therapist B was performed. The following medical record ICD-9 codes which correspond to cervical somatic dysfunction were utilized: myositis (729.1), postural strain (729.2), cervical sprain/strain (847.0), and neck pain (723.1). The medical records reviewed did not date earlier than 1991.

Data was collected on a data form and included these items: age, sex, cervical range of motion, number of treatments, initial to final treatment duration, physical therapy treatment methods, treatment outcomes, modality usage and types of exercises performed, tender points treated, patient subjective change in pain levels, and total cost of treatment (Appendix).

Total cost of treatment includes all treatment sessions from initial evaluation to discharge. All modality and exercise charges were included in the total cost of treatment as well. Modality charges ranged from $20 to $39 per modality, and manual techniques and exercises ranged from $27 to $49 per technique. Total cost of treatment is reported in fiscal year 1997 dollars. When cervical range of motion was reported at "Within Normal Limits" (WNL), then the following ranges were used in statistical analysis.[32]

| | |
|---|---|
| Flexion | 45 degrees |
| Extension | 45 degrees |
| Lateral flexion | 45 degrees |
| Rotation | 60 degrees |

Identification numbers were used for subject names to maintain data confidentiality. The list of names and identification numbers will be kept in a locked cabinet in room 1531 of the University of North Dakota Physical Therapy Department for three years and then destroyed.

**INSTRUMENTATION**: Therapist B, the Strain/Counterstrain-trained therapist, utilized a cervical range of motion unit (CROM) for measurement (Performance Attainment Associates, 958 Lydia Dr, Roseville, MN 55113). The CROM unit has been found to be reliable in measuring cervical range of motion.[33,34] Intertester reliablity for cervical motion measurement has been found to be more reliable with the CROM than a universal goniometer.[35]

Therapist A used visual estimation (VE) and "mild", "moderate", and "severe" as descriptors for limitation of cervical motion. As degrees of motion cannot be quantitatively compared to the descriptors, only the CROM unit measurements will be considered in this study.

Therapist B also used a verbal numerical pain scale, with zero as no pain and 10 as the worst pain imaginable. Subjects respond to the question verbally as well. This pain

scale has been studied and found to be reliable.[36] Therapist A did not utilize a pain scale, so comparisons between groups cannot be made.

**DATA ANALYSIS**: Data were analyzed using descriptive and analytical statistics to compare treatment outcomes of subjects treated with Strain/Counterstrain or McKenzie's exercises.

## Chapter IV

## Results

Subjects: A total of 26 patients fit the criteria established in the methods. Therapist A (McKenzie group) treated 10 subjects, and Therapist B (SCS group) treated 16 subjects. Mean age of the McKenzie group was 42.5 years (SD=11.0), and the SCS group was 34.7 years (SD=5.1). One way analysis of variance (ANOVA) shows that the groups are not statistically different in age ($F(6,3)=1.105$, using $p<.05$). Tables 1 and 2 show descriptive statistics for each group. Females predominated in both groups, with the SCS group at 87.5% and the McKenzie group at 90%. The SCS group had 75% of the subjects experience cervical dysfunction due to trauma, whereas the McKenzie group saw a somewhat higher percentage of trauma patients at 80% (Figure 7).

Cost of treatment for the McKenzie treated group averaged $750, while the SCS group averaged $567 for treatment. Mean duration of treatment for the McKenzie group was 2.5 months (SD=1.7), while the SCS group was half that at 1.2 months (SD=1.1). One way ANOVA shows that this is not a significant difference in treatment duration between groups ($F(6,3)=.590$, using $p<.05$).

Mean total number of treatments for the McKenzie group was 14.8 (SD=8.2), whereas the mean total number of treatments for the SCS group was 8.1 treatments (SD=5.9). Analysis of variance revealed that the McKenzie group total number of treatments were not significantly different than the SCS groups ($F(7,2)=2.494$, using $p<.05$).

**Descriptive Statistics**

| | N | Range | Minimum | Maximum | Mean |
|---|---|---|---|---|---|
| | Statistic | Statistic | Statistic | Statistic | Statistic |
| AGE | 14 | 16.00 | 25.00 | 41.00 | 34.7143 |
| CAUSE | 16 | 2.00 | 1.00 | 3.00 | 1.5000 |
| COST | 16 | 1218.00 | 156.00 | 1374.00 | 567.1250 |
| DURATION | 16 | 3.28 | .22 | 3.50 | 1.2669 |
| POINT | 16 | 24.00 | 5.00 | 29.00 | 15.5000 |
| SEX | 16 | 1.00 | 1.00 | 2.00 | 1.1250 |
| TREATMEN | 16 | 22.00 | 1.00 | 23.00 | 7.6875 |
| PAIN | 16 | 6.00 | 4.00 | 10.00 | 7.5000 |
| END | 16 | 3.00 | .00 | 3.00 | 1.5000 |
| Valid N (listwise) | 14 | | | | |

**Descriptive Statistics**

| | Std. | Variance | Skewness | | Kurtosis | |
|---|---|---|---|---|---|---|
| | Statistic | Statistic | Statistic | Std. Error | Statistic | Std. Error |
| AGE | 5.1505 | 26.527 | -.872 | .597 | -.122 | 1.154 |
| CAUSE | .8944 | .800 | 1.278 | .564 | -.440 | 1.091 |
| COST | 390.6651 | 152619.2 | .788 | .564 | -.444 | 1.091 |
| DURATION | 1.1187 | 1.251 | .743 | .564 | -.809 | 1.091 |
| POINT | 7.1926 | 51.733 | .353 | .564 | -.730 | 1.091 |
| SEX | .3416 | .117 | 2.509 | .564 | 4.898 | 1.091 |
| TREATMEN | 5.7239 | 32.762 | 1.431 | .564 | 2.321 | 1.091 |
| PAIN | 1.9664 | 3.867 | -.271 | .564 | -1.203 | 1.091 |
| END | 1.0954 | 1.200 | -.174 | .564 | -1.218 | 1.091 |
| Valid N (listwise) | | | | | | |

Table 1. Descriptive statistics of SCS group.

**Descriptive Statistics**

| | N | Range | Minimum | Maximum | Mean | Std. |
|---|---|---|---|---|---|---|
| | Statistic | Statistic | Statistic | Statistic | Statistic | Statistic |
| AGE | 10 | 39.00 | 21.00 | 60.00 | 42.5000 | 10.9874 |
| CAUSE | 10 | 2.00 | 1.00 | 3.00 | 1.3000 | .6749 |
| COST | 10 | 1044.00 | 156.00 | 1200.00 | 749.8000 | 289.3294 |
| DURATION | 10 | 5.75 | 1.25 | 7.00 | 2.5000 | 1.6915 |
| TREATMEN | 10 | 30.00 | 3.00 | 33.00 | 13.7000 | 8.2199 |
| SEX | 10 | 1.00 | 1.00 | 2.00 | 1.1000 | .3162 |
| Valid N (listwise) | 10 | | | | | |

**Descriptive Statistics**

| | Variance | Skewness | | Kurtosis | |
|---|---|---|---|---|---|
| | Statistic | Statistic | Std. Error | Statistic | Std. Error |
| AGE | 120.722 | -.333 | .687 | .682 | 1.334 |
| CAUSE | .456 | 2.277 | .687 | 4.765 | 1.334 |
| COST | 83711.511 | -.565 | .687 | 1.119 | 1.334 |
| DURATION | 2.861 | 2.524 | .687 | 6.734 | 1.334 |
| TREATMEN | 67.567 | 1.398 | .687 | 3.133 | 1.334 |
| SEX | 1.000E-01 | 3.162 | .687 | 10.000 | 1.334 |
| Valid N (listwise) | | | | | |

Table 2. Descriptive statistics of McKenzie group.

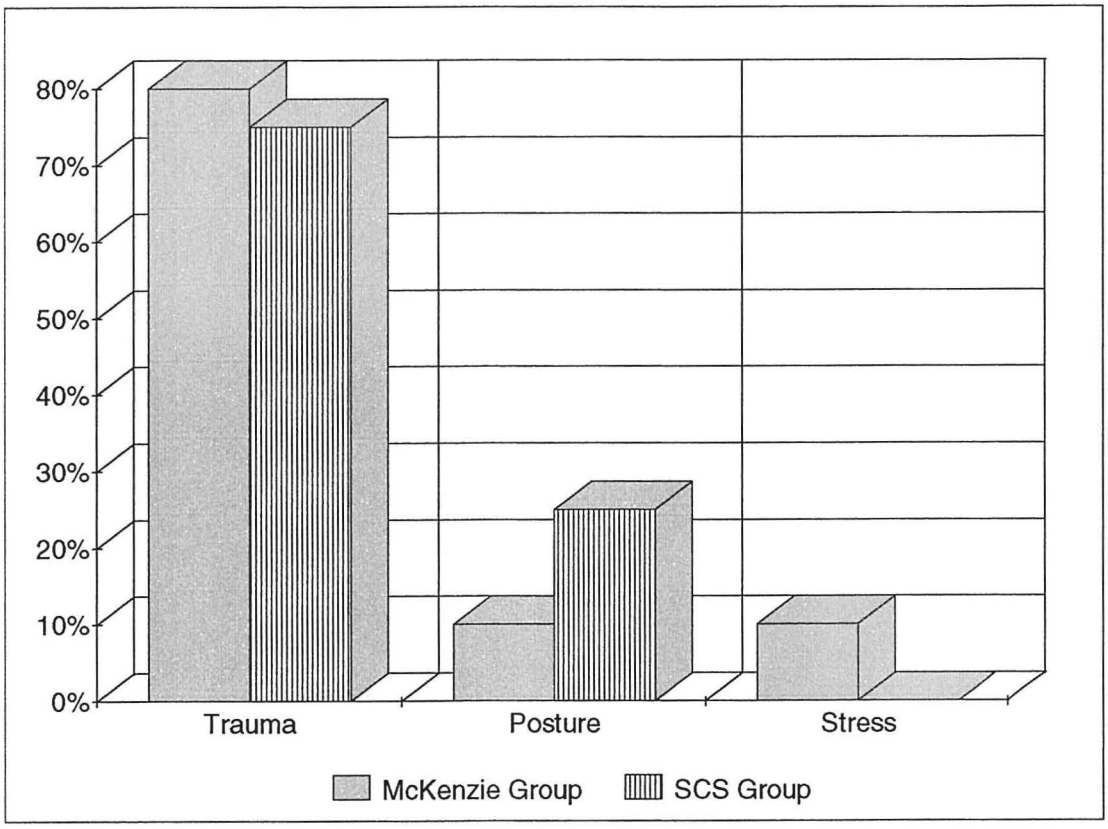


**Figure 7.** Comparision of causes for cervical somatic dysfunction in each group by using percentages.

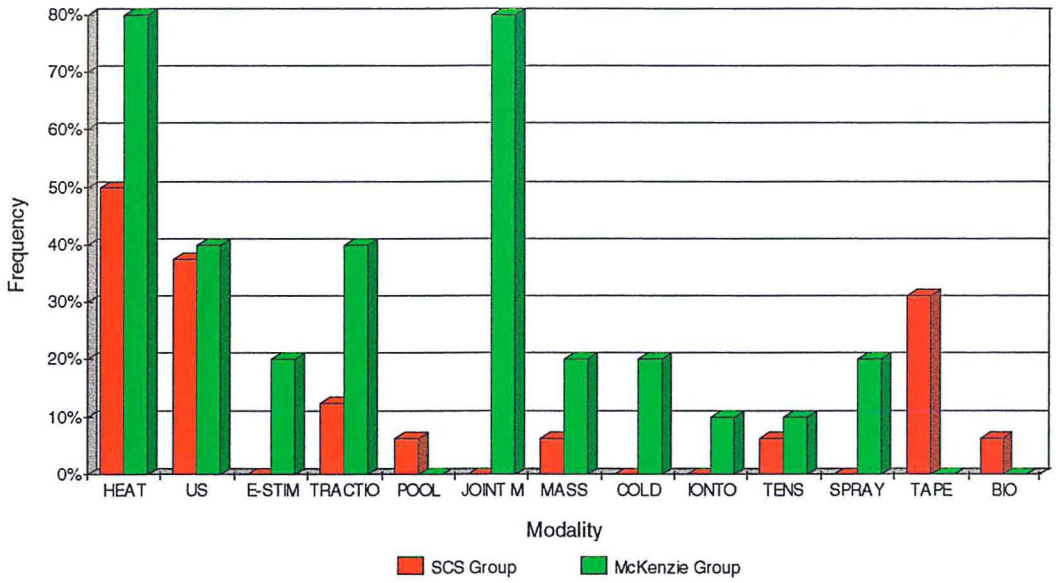


**Figure 8.** Frequency comparison of modality use between SCS and McKenzie groups. US=Ultrasound, Joint Mo=Joint Mobilizations, Spray=Spray&Stretch, Tape=Scapular Taping, and Bio=Biofeedback.

0% of the SCS group. The McKenzie group received a wider variety of modalities, with generally higher frequency of modality use. The SCS group was treated most often with heat, ultrasound, and scapular taping.

Upon initial treatment, the SCS group subjectively rated their pain on a 0-10 scale, with 0 as no pain and 10 as the worst pain imaginable. Initial pain for the SCS group ranged from a four to a 10, with 56.4% between an 8-10 on the scale (M=7.5, SD=1.9). Upon discharge, the SCS group rated pain between zero and three (M=1.5, SD=1.1). Table Three shows pain scale ranking percentages at discharge. Paired samples t test shows that this is a significant reduction in pain for the SCS group ($t(15)= -16.43$, $p<.05$, two-tailed). The records of the McKenzie group did not have subjective descriptors of pain, whether numerical or otherwise, so data was not available to compare pain changes between groups.

For the SCS group, paired samples t tests showed that range of motion was significantly improved in flexion, bilateral rotations, and right lateral bend ($p<.05$, 2-tail). Extension was not significantly improved. Table Four provides t test data for cervical motions. Objective data for the McKenzie group's cervical range of motion was not available.

Figure Nine shows the total number of tender points treated in the SCS group by area. The area most commonly treated for tender points for the SCS group was in the posterior cervical area with 81 points, followed by the anterior cervical points. Points were found in the posterior ribs, thoracic spine, shoulder, and on the cranium with the corresponding treatment positions used.

| Pain Scale | Percentage |
|---|---|
| 0 | 25.0% |
| 1 | 18.8% |
| 2 | 37.5% |
| 3 | 18.8% |

**Table 3**. SCS group percentages of pain ranking on pain scale at discharge (zero=no pain, 10=worst pain).

| **MOTION** | **df** | **t** | **Significance** (2-tailed) |
|---|---|---|---|
| Extension | 15 | 1.911 | .075 |
| Flexion | 14 | 2.563 | .023* |
| Left Side Bend | 15 | 2.402 | .030* |
| Right Side Bend | 15 | 3.126 | .007* |
| Left Rotation | 14 | 3.094 | .008* |
| Right Rotation | 14 | 2.651 | .019* |

**Table 4**. SCS group paired samples t test data for cervical motions (*significant, p<.05).

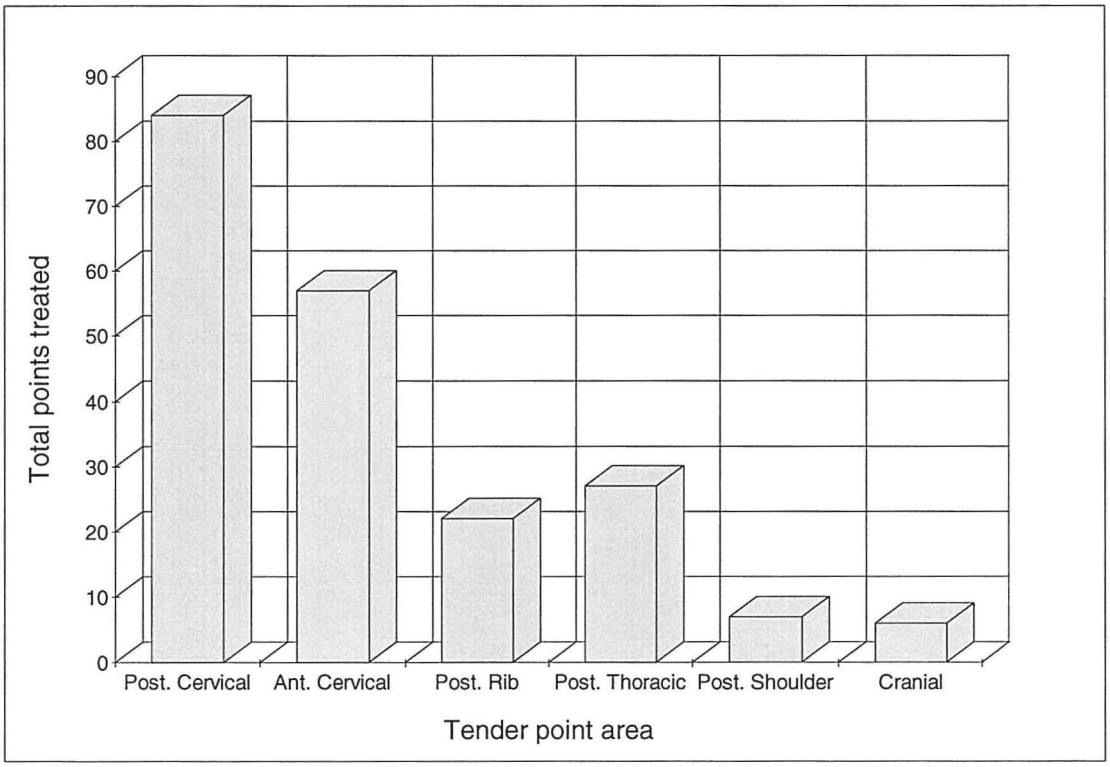


**Figure 9.** Total number of tender points treated in each area of SCS group, where post=posterior, and ant=anterior.

# DISCUSSION

The subjects of the groups were not significantly different in the areas of age, sex, and cause of cervical dysfunction. Sample size, on the other hand, may limit this study. The SCS group had 16 subjects and the McKenzie group had 10. According to the Central Limit Theorem, when the sample size is less than 30, as in this study, the results of comparing SCS and McKenzie groups are less generalizable to the rest of the population due to the variability between groups.[37]

The mean duration of treatment time for the McKenzie group was nearly double that of the SCS group, although ANOVA showed that this was not significant. As the data for treatment duration were recorded in months, it is conceivable that the results may be misrepresented. For example, 1.2 is very close to 2.5 when considered on the entire number scale. But when those numbers are changed from the units of months to days, then 36 days is much shorter than 74 days (based on 30 day calendar). Therefore, it is very likely that the ANOVA data show a different picture than what is clinically relevant. Regardless of whether it is statistically less or not, it is clinically relevant to a patient who is in pain and limited in function and their third party payer that total treatment time was half as long for the SCS group when compared to the McKenzie group. No other data is available from other investigators with which to compare these results.

During the study, neither data regarding whether the injury was in the acute or chronic stage of healing, nor data recording how long from initial injury to beginning of treatment were gathered. A chronic injury is more likely to have developed scar tissue and healing, therefore taking longer to treat than an acute injury. Severity of injury may have contributed to treatment duration as well, although it was not assessed in this study as pain

scale and range of motion data were not available for the McKenzie group. Lack of information regarding stage and severity may limit the results of the study.

Of the SCS group, two individuals who had completed therapy returned following a second trauma. One was in a motor vehicle accident and the other was hit in the head by a ball. These individuals were considered new subjects in this study as they had successfully completed therapy and were independent in pain and range of motion management until the time of the second trauma. It may be expected that a learning factor may influence the second set of scores, as the patients were already familiar with the exercises, positions, potential treatment outcomes, and home exercise program at the time of their second treatment duration. Even considering that education is part of physical therapy treatment and a learning factor may have influenced the scores, it is important to note that these individuals' second set of scores were similar to their previous scores. It is not known whether their first and second responses to SCS are reflective of what the general population may experience, and utilizing both set of scores may have influenced the data.

Pain rating for the SCS group did significantly improve from initial to final visit, as noted in the results. With a mean treatment duration of 1.2 months, this seems like a reasonable amount of time for tissue healing following trauma. Even though comparisons cannot be made with the McKenzie group for effectiveness in decreasing pain, finding that cervical pain secondary to cervical somatic dysfunction can be effectively reduced by SCS is promising as no previous literature has been available to support this reported outcome.

In addition to pain being significantly improved for the SCS group, cervical flexion, rotations, and bilateral bends were significantly improved as well. Considering that 31% of the patients had no limitation in cervical ROM at their initial evaluation, the findings are surprising. Extension was not significantly improved, but 69% had motion within normal limits at their initial visit, so conclusions regarding SCS effectiveness in improving extension cannot be reliably made based on the data in this study.

Although the CROM unit is considered a reliable and valid test for cervical motions as previously described, not all motions were recorded in degrees in the SCS subjects' charts. When the subjects' motions approximated normal during their course of treatment, the results were recorded as "Within Normal Limits" (WNL). By using the American Academy of Orthopedic Surgeons (AAOS) guidelines as described in the methods, the subjects' end results may have been over or under estimated. In addition, the AAOS guidelines, although commonly used by physical therapists (at least a new class of 50 each year graduating at University of North Dakota), do not state norms for age, sex, or even state sample size. The SCS trained therapist utilized similar guidelines as the AAOS. Although this limits the accuracy of the cervical ROM statistics, to this date, no SCS ROM data has been available in the literature, so the results are important to note nonetheless.

It is recommended that future studies utilize established cervical ROM norms for the instrument being used. In 1992, a group of researchers established norms measuring cervical range of motion in healthy subjects using the CROM unit.[38] Inter and intratester reliability was established prior to performing the study and found to be acceptable (ICC's >.80). Norms were recorded for intervals of every 10 years of age ranging from 11-97. Norms for each gender were established as well, and there were more than 20 subjects in each category of age and gender except for females aged 80-89, and both sexes aged 90-97.

Modalities were highly varied in their use between therapists. This may be due to a number of reasons such as physician preference when writing orders, physical therapist preference or training, or patient differences in response to treatment. In this study, comparing groups showed that more modalities did not equate faster healing time or fewer number of treatments. Increased modality use in the McKenzie group may partially account for the higher cost of treatment seen by the McKenzie group as well.

To make the results of a chart review such as this more reliable the following additional points would need to be addressed: 1. larger sample, 2. categorize patients into acute and chronic groups, 3. standardize cervical motion and pain scale measurement between groups before subjects are treated, and 4. use established norms for joint ROM.

It is recommended that controlled scientific studies be performed using SCS and McKenzie protocols to better document their effectiveness on treatment outcomes. A controlled study would not have the wide number of confounding variables that a medical chart review may find.

ID#:_____
Age: _____
Sex: _____

Therapist # :_____
Diagnosis ICD-9: _____ Trauma Repetitive Stress Postural

Total treatments: _____
Treatment duration: _____
Total cost or units: _____

**Subjective information**:
Pain scales:
Initial:_____ Mid:_____ Final:_____
Pain descriptors: _____

**Objective information**:
Cervical range of motion:

| | | | |
|---|---|---|---|
| INITIAL: | Flexion:_____ | FINAL: | Flexion:_____ |
| | Extension:_____ | | Extension:_____ |
| | Side bend R:_____ | | Side bend R:_____ |
| | Side bend L:_____ | | Side bend L: _____ |
| | R rotation:_____ | | R rotation: _____ |
| | L rotation:_____ | | L rotation: _____ |

Functional range of motion:_____
_____
_____

Treatment modalities:

| | |
|---|---|
| _____ Ultrasound | _____ Joint mobilizations |
| _____ Heat | _____ Massage |
| _____ E-stim | Cold _____ |
| _____ Traction | Soft tissue mobilizations _____ |
| _____ Pool | Other _____ |

Stretching: _____
Exercises: _____
_____

Tender/trigger points treated: _____
_____

## REPORT OF ACTION: EXEMPT/EXPEDITED REVIEW

**University of North Dakota Institutional Review Board**

**DATE:** September 3, 1997 **PROJECT NUMBER:** _____

**NAME:** Heather Sorum; David Relling **DEPARTMENT/COLLEGE:** Physical Therapy

**PROJECT TITLE:** An Outcomes Comparison of Treatment of Cervical Dysfunction by Strain/ Counterstrain or McKenzie's Exercises

The above referenced project was reviewed by a designated member for the University's Institutional Review Board on _____ and the following action was taken:

☐ Project approved. **EXPEDITED REVIEW** No. _____.
Next scheduled review is on _____.

☐ Project approved. **EXEMPT CATEGORY** No. _____. No periodic review scheduled unless so stated in the Remarks Section.

☒ Project approved **PENDING** receipt of corrections/additions. These corrections/additions should be submitted to ORPD for review and approval. **This study may NOT be started UNTIL final IRB approval has been received.** (See Remarks Section for further information.)

☐ Project approval **deferred. This study may not be started until final IRB approval has been received.** (See Remarks Section for further information.)

☐ Project **denied.** (See Remarks Section for further information.)

**REMARKS:** Any changes in protocol or adverse occurrences in the course of the research project must be reported immediately to the IRB Chairperson or ORPD.

Approval from Attn on Men's statement.

* Please clarify - are records of only two individuals performing PT involved? If so, indicate in protocol & in Attn letter - If NOT, please indicate how accounting for effects of various therapists.

cc: David Relling, Adviser

Signature of Designated IRB Member
UND's Institutional Review Board

Sept 4, 1997
Date

If the proposed project (clinical medical) is to be part of a research activity funded by a Federal Agency, a special assurance statement or a completed 310 Form may be required. Contact ORPD to obtain the required documents.

(3/96)

Altru
Health System

**REQUEST FOR PERMISSION TO CONDUCT RESEARCH STUDY AT ALTRU HEALTH SYSTEM**

NAME: Heather Sorum, SPT DATE: 9/19/97

ADDRESS: PT Dept, UND P.O Box 9037 TELEPHONE #: 777-9720
Grand Forks, ND 58202

DEPARTMENT/COLLEGE: physical therapy

PROJECT TITLE: An Outcomes Comparison of treatment of Cervical Dysfunction by Strain/Counterstrain or McKenzie's Exercises

Your request to conduct the above named study at an Altru Health System facility involving employees or patients as participants, and/or requiring facility resources has been reviewed. The following action has been taken:

✓ Permission to conduct the study is granted

_____ Permission to conduct the study will be granted upon completion of the following:

_____

_____

_____ Permission to conduct the study is denied for the following reason(s):

_____

_____

_____

RECOMMENDATIONS/REMARKS:

Signature: Virginia Eggleston Date: 9/19/97
Manager, Research

word\research\prmsnfrm

Altru Hospital
1200 South Columbia Road ■ P.O. Box 6002 ■ Grand Forks, ND 58206-6002 ■ 701-780-5000

Grand Forks Medical Park
Institutional Review Committee
1000 South Columbia Road • Grand Forks, North Dakota 58201 • (701) 780-6161

MEMORANDUM

To: Heather Sorum
David Relling
Physical Therapy Department
University of North Dakota
Box 9037
Grand Forks, ND 58202

From: Ricardo E. Alvillar, M.D.
Chair, Medical Park Institutional Review Board

Date: October 1, 1997

Re: An Outcome Comparison of Treatment of Cervical Dysfunction by Strain/Counterstrain or McKenzie's Exercises

The above study was approved by Exempt Category No. 3. Attached is a copy of the Research Project Action Report for your records. Please change the proposed project date from 9/1/97 to 10/1/97 to coincide with the date your study was approved.

REA/ert
Enc.

Grand Forks Medical Park

# Institutional Review Board

## Research Project Action Report

Date: September 24, 1997 IRB#: PT-005

Principal Investigator: Heather Sorum/David Relling Department: Physical Therapy Phone #: 777-9720

Research Coordinator: _____ Phone #: _____

Project Title: An Outcome Comparison of Treatment of Cervical Dysfunction by Strain/ Counterstrain or McKenzie's Exercises

The above referenced project protocol and informed consent was reviewed by the Medical Park Institutional Review Board on _____ and the following action was taken:

☐ Project approved. Next Scheduled review is on _____
If no date is given, then review will be required in 12 months. (See REMARKS SECTION for any special condition.)

☐ Project approved. EXPEDITED REVIEW NO. _____
Next scheduled review is on _____

☒ Project approved. EXEMPT CATEGORY NO. _____
No periodic review scheduled unless so stated in REMARKS SECTION.

☐ Project approval deferred. (See REMARKS SECTION for further information.)

☐ Project denied. (See REMARKS SECTION for further information.)

☐ Amendment approved

**REMARKS:**

Any changes in protocol, adverse occurrences or deaths in the course of the research project must be reported immediately to the IRB chairperson or the IRB office (780-6161).

Richard E. Hartman, MD 1 Oct 97

Signature of Chairperson or Designated IRB Member
Medical Park Institutional Review Board

Date

If the proposed project is to be part of a research activity funded by a federal agency, a special assurance statement or a completed 596 Form may be required. Contact IRB office to obtain the required documents.



8012-0002 MAR 94

## LEAD IRB DESIGNATION SHEET

I have reviewed the proposal received from Heather Sorum and David Relling (Department of Physical Therapy, University of North Dakota), entitled "An Outcomes Comparison of Treatment of Cervical Dysfunction by Strain/ Counterstrain or McKenzie's Exercises" and recommend that the Medical Park/~~University of North Dakota~~ Institutional Review Board be the lead IRB because subjects will be accrued at their institution.

F. Richard Ferraro, Ph.D., Chair
University of North Dakota
Institutional Review Board

Ricardo Alvillar, M.D., Chair
Medical Park
Institutional Review Board

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